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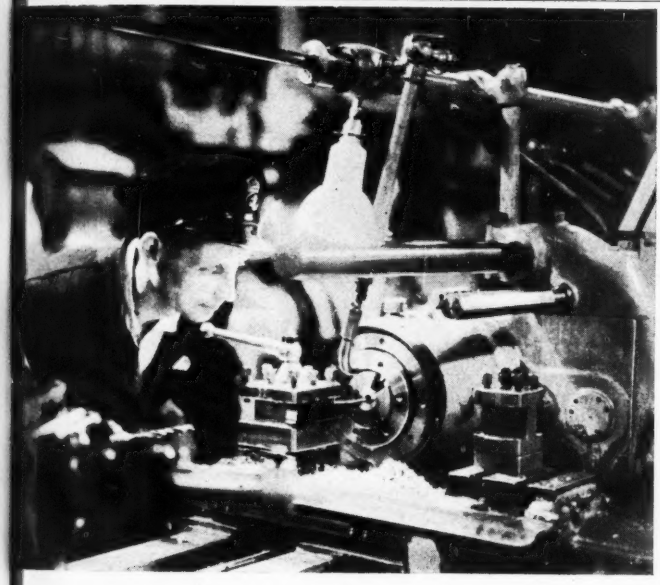
XXXVI.—No. 8 August, 1943 Price 9d.



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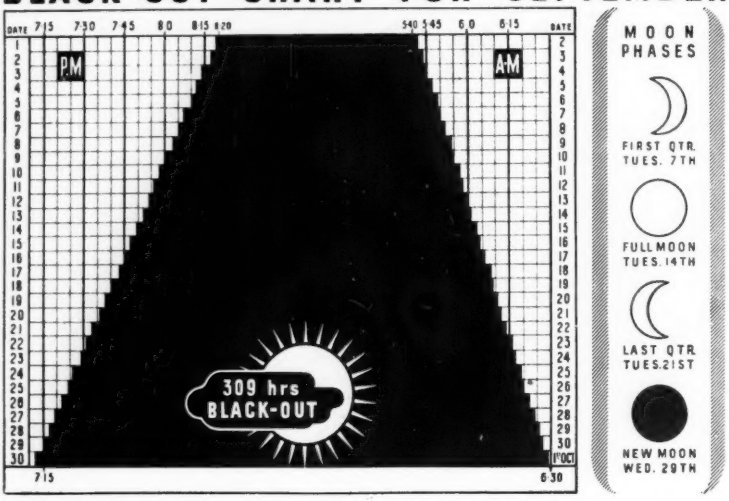

★ *Times shown are those for the London area.*

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September sees the commencement of the fifth year of the War. Black-out is before us again. Increased output must not be hindered. The question of still greater production is the vital need of the nation.

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A Fifty Years Plan

MANY readers have doubtless inspected the fascinating display of London of the future at the London County Hall. Here are sectional exhibits showing how self-contained communities can be built up, open spaces increased and more evenly distributed, road and rail transport secured.

If this plan develops on anything like the scale anticipated there should be great opportunities for lighting, on the new circular and arterial roads, on the new tunnels and subways projected, and on the new river frontage, where lighting conditions in keeping with the dignity of the conception should be available.

The plan is intended to proceed in stages, first, Housing in the East End and Thames South Bank Areas, next improvements to the South Bank River Frontage and adjacent areas, then new roads where urgently needed—and other enticing but more visionary steps later still. Fifty years is suggested for its complete realisation—it might well be more.

There is plenty of time, therefore, in which to plan the Lighting of the New London. We should like to see a start made now—an effort to suggest what portions of this fine new city might look like when fitly illuminated, and to indicate how these conditions might be achieved.

I.E.S. Areas

A new stage will be reached in the organisation of I.E.S. Centres and Groups on October 1, when for the first time Areas will come into being, each represented on an Areas Joint Committee and on the Council. At the present only in two Areas, the Midland and North Midland, do more than one Centre exist, so that in others the Centre Committee will continue as the local body. In time to come the number of Centres will doubtless increase progressively, and there is at least one Area (the South-Eastern) where Centres and Groups have yet to be formed. The Area plan, however, should meet all such future contingencies.

End of Double Summer Time

The ending of double summer time on August 14 and the imminence of longer and darker nights has led to renewed suggestions in the daily Press for a relaxation of the black-out. If, as we all hope, the position continues to improve and the danger of severe hostile air attack to recede, this demand will doubtless become more insistent. At the moment no radical departure in policy seems likely, but the authorities would do well to consider possible alleviation, on lines which the I.E.S. has already indicated—and to be prepared with definite plans for partial restoration of public lighting in good time before the opportune moment. The agitation at least serves to show the short-sightedness of those who have been urging the scrapping of lamp posts—on the existence of which quick restoration of public lighting depends.

War and Peace

An excellent example of the possibilities of lighting in stagecraft was afforded by the performance of Tolstoy's "War and Peace" at the Phoenix Theatre. The use of a spotlight brought the narrator into prominence and permitted changes of scenery in the dark background. Very skilful use was made of the projection of scenery on a drop sheet at the back of the stage, which enhanced the successful application of the same simple implements to create quite different scenes—a staircase and ballroom, a garden terterrace, a dug-out, or a battle scene. It has always seemed to us that more might be done with the "magic lantern" in a theatre, especially when the play demands a succession of different scenes.

The Oxford Ophthalmological Congress, 1943

At this congress addresses on various aspects of Illumination in Industry were presented by Sir Duncan Wilson, Mr. H. C. Weston and Dr. E. R. Merewether, and strong support was given to the proposal of Sir John Parsons that a joint I.E.S. Committee to study light and vision should be appointed.

An interesting feature of the Oxford Ophthalmological Congress, held on July 8 and 9, was a discussion on Illumination in Industry, to which the afternoon of the second day was devoted. The discussion was opened by Sir Duncan Wilson, followed by Mr. H. C. Weston and Dr. E. R. Merewether, H.M. Senior Medical Inspector of factories.

Illumination in Industry.

In his opening paper, Sir Duncan Wilson briefly reviewed recent progress in lighting. He reminded the Congress how late was the recognition of good lighting as an important factor in social life, very little attention being paid to it at the beginning of the present century. Even now the only premises subject to legal requirements in respect of lighting are factories and shops. After outlining the regulations based on the recommendations of the Departmental Committee on Factory Lighting, Sir Duncan drew attention to the absence of any statutory provision for the regulation of conditions of lighting in offices—a situation which he felt is difficult to justify. Apart, however, from legislation, much has been done by the I.E.S. in formulating standards of illumination as recommended practice, and the I.E.S. code has received official recognition. Scientific and technical progress in electric and gas lighting has been great during the past twenty years and, largely in consequence of this, the cost of lighting per candle-hour has been very substantially reduced.

Dealing with recent research work on lighting in relation to vision, Sir Duncan referred to some of the results of the work of Lythgoe, Stiles, Wright, and Weston. These researches had been fathered by the Committee on the Physiology of Vision of the M.R.C., under the chairmanship of Sir John Parsons, and its counterpart, the Illumination Research Committee of the D.S.I.R., under the chairmanship of Dr. C. C. Paterson. For reasons which were a mystery to him, the latter committee was disbanded before the war.

Field investigations showing the relation between illumination and industrial efficiency had been undertaken by the Industrial Health Research Board, and here the work of Elton, Weston, Wyatt, and Adams has shown the importance of lighting in both fine and rough work, and in highly mechanised as well as manual processes.

The Study of Lighting and Vision.

In his concluding remarks Sir Duncan dealt with a few general points which he said struck him on reviewing the position as a whole. In the first place, the study of lighting and vision should be tackled conjointly, or at least simultaneously, by biologists and physicists, using both these terms in their broadest sense. Yet almost all of the names he had mentioned were those of physicists or engineers, and he felt that biologists are very inadequately represented even in the study of strictly visual problems. As regards lighting, he was rather astonished at the lack of interest, indeed indifference, hitherto shown by biologists in this subject, notwithstanding that vision and lighting are exactly complementary, and that progress in either on right lines cannot be made without taking both into account. As an instance, he quoted the wholly negative result of an inquiry to ophthalmologists by the Factory Lighting Committee in its early days asking for evidence as to the effect of bad conditions of lighting on eyesight. Much later, it was true, Sir Stewart Duke-Elder started to investigate the rate of deterioration of vision through the performance of fine work at the London School of Printing, and the results were published in the Journal of Ophthalmology in 1930. There are, however, signs that interest is growing, and he understood that some ophthalmologists were present at two recent meetings of the I.E.S. which provided interesting discussions on the effectiveness of lighting and its numerical assessment, and on proposals for a new lighting code.

Collaboration of Biologists and Physicists

Sir Duncan said he had two suggestions to make for increasing the collaboration between biologists and physicists in the study of lighting problems. The first referred to Government

committees. Biological science had been strongly represented on the Factory Lighting Committee from the very start, and he had always insisted that this should be continued. Similarly the Illumination Research Committee had an ophthalmologist (Sir John Parsons) as a member, while the Physiology of Vision Committee had a physicist (Dr. J. W. T. Walsh) as a member. He felt strongly that this practice should be followed in future and was, therefore, sorry that no ophthalmologist had been appointed a member of the committee on the Lighting of Post-War Buildings.

An I.E.S. Joint Committee

His second suggestion concerned the I.E.S., which, at present, includes an almost negligible number of biological members. Sir John Parsons, in his recent fine address to the Society, made the valuable proposal that it should have a physiological committee of its own. Until, however, it has an adequate number of physiological members from among whom to form this committee, Sir Duncan suggested that a joint committee of the I.E.S. and the Ophthalmological Committee might be set up to consider such questions as the application of light in relation to health and to the comfort and accuracy of vision.

Following Sir Duncan Wilson, Mr. H. C. Weston said that his remarks, on the subject of illumination and industrial efficiency, would be confined to a few points which he thought would be of particular interest to members of the Congress as ophthalmologists. "Ordinary" visual tasks in industry (not more difficult than, e.g., reading newsprint) could be done with reasonably high efficiency at illuminations falling within a narrow range, from about 5 or 6 ft.c. to double these values. But the range required for "fine" and "very fine" work is much wider, extending up to as much as 1,000 ft.c. With predominantly visual tasks, e.g., some inspection processes in industry, the illumination required for efficient performance increases very rapidly as size diminishes below the "ordinary" limit.

Referring to classifications of industrial processes according to the illumination they require, Mr. Weston recalled that one of the earliest of these is given in the Third Report of the Factory Lighting Committee (1922), where, at least for engineering processes, the limits to which work has to be done is taken as a numerical index of "fine" and "very fine" work. Beuttell had gone further, and suggested the analysis of visual tasks and measurement of the detail they present, as a basis of classification. Without such analysis no very precise diagnosis of the severity of visual tasks can be made, either for the purpose of specifying the desirable illumination or the visual capacity required. Thus, task analysis and measurement must be of value to the ophthalmologist as well as to the "illuminologist," and, despite its difficulties, it should be attempted.

Effect of Size of Work

The effect of the size of work on the illumination required for efficient performance has been studied and the results published by the D.S.I.R. in 1935. From this work and the earlier work of Lythgoe on visual acuity (1932), a relation can be found between the "basic" acuity for a given task and the acuity corresponding with the illumination at which efficient performance is obtained. Within certain limits "efficient acuity" appears to be a logarithmic function of "basic acuity," and Mr. Weston showed several diagrams illustrating the derivation of this relation. From this it appears that sustained visual tasks requiring so-called "normal" acuity are only done efficiently when the illumination is sufficient to give more than double this acuity. With less exacting visual tasks the ratio $\frac{\text{"efficient" acuity}}{\text{"basic" acuity}}$ is still higher, because there is not a constant proportionality between the two acuity levels as the basic requirement falls. This is only a way of expressing the ratio $\frac{\text{optimum illumination}}{\text{minimum illumination}}$ in ophthalmological, or physiological, terms, but the relation might be made a basis for setting visual standards in industry. It showed that the highest standard specified should not be less than 6/3, instead of the more usual 6/6 vision. In the ophthalmic selection of "fine" workers this would involve facilities for illuminating test-types, or other test-objects, up to about 500 ft.c. when necessary. Persons who cannot reach the prescribed "efficient" acuity for a given task, but are otherwise suited to the work, need not be rejected, providing the visual task is, in effect, relaxed by the use of appropriate optical aids.

The Needs of the Individual

Continuing, Mr. Weston said he wanted to make a further point concerning individual differences of light-need. Recommended standards of illumination are based on the needs of

the "average" worker. But individuals differ widely in their response to illumination, and, with any typical group of persons doing the same work, the standard of industrial efficiency reached can only be maximal when conditions are made ideal for the worst worker. There is, therefore, something to be gained by exceeding recommended standards of lighting, though it is a problem in economics as to how far this excess should go, i.e., for what degree of visual inferiority (after correction of manifest defects) the conditions of lighting should be planned. This question is relatively unimportant in places of employment well planned for daylight but, with artificial lighting, it is rare to find current recommended conditions bettered, though a considerable proportion of people need better conditions. Everyone appears to experience a comfortable degree of warmth at work, under given conditions of activity, within a small range of temperatures, $-$ t $\pm$ about 15 per cent. But, with illumination, the extremes of the range may be in a ratio of the order of 100 : 1. This is evident in the results of tests, whether the method of choice is used, or when performance is the criterion taken.

To illustrate this, Mr. Weston analysed, with the aid of graphs, the results obtained from a typical group of persons doing fine work. For a given performance it was shown that the "average" worker required 8 times the illumination required by the "average superior" worker, while the "average inferior" worker needed 40 times the illumination which sufficed for the "average" worker. For a given *percentage* of the respective maximum performances the necessary values of illumination differed less, though the inferior workers required 3 times as much illumination as the superior. It was also shown that the *degree* of inferiority is a function of illumination, so that the inequality of workers is reduced, though not abolished as illumination is increased. The magnitude of individual differences of light-need—especially for fine work—is one of the difficulties in fixing standards of adequacy, and should be a warning against generalising from a few cases. Thus, the best method of lighting for efficiency in fine work is usually a combination of general with individual lighting.

The Ophthalmologist in Industry

Dr. Merewether addressed the Congress on the rôle of the ophthalmologist in industry. He drew attention to the eye hazards involved in certain occupations, and referred especially to the use in industry of various toxic substances from which ophthalmic symptoms might arise. He agreed with Mr. Weston that the organisation of modern industry for production has increased the number of persons exposed to risk of eyestrain, and there is an important rôle for the ophthalmologist, as well as for good lighting, in industry. Speaking first in the general discussion which ensued, Dr. R. S. F. Schilling (Industrial Health Research Board) referred to the very exacting demands upon visual capacity made by a number of industrial processes, and the importance of securing proper conditions of lighting for them. He had in mind, particularly, some of the operations involved in fuse making, and it would be very interesting to know whether ophthalmologists were getting many cases of eyestrain in persons engaged on such work. He thought industry should enlist the help of ophthalmologists to set up visual standards, and to examine prospective employees. The rough tests now applied in some factories were not enough.

Complaints of Eyestrain

A number of members of the Congress joined in the discussion. Several mentioned that they had been consulted by managements who had received numerous complaints of eyestrain and, on visiting the factories concerned, had been impressed by the complexity of the problem of achieving satisfactory lighting. In one case the workers had refused to work in artificial light, and in certain Sheffield factories lighting was found to be particularly unsatisfactory. The view was expressed that the artificial lighting of factories often showed insufficient appreciation of the importance of the quality of lighting, and of its psychological effects. Ordinary discharge lamps did not seem desirable in this respect, and some dissatisfaction had been encountered even where the new daylight discharge lamps were used. Both in factories and offices the brightness contrasts encountered are often not conducive to ease of vision and general satisfaction with the lighting. With regard to daylight, architects seemed to be badly instructed in the principles of good lighting, and windows were often badly designed. "In the outpatient department one sees the results of other people's mistakes."

Sir John Parsons said it is now known that very much higher values of illumination are desirable for some industrial

tasks than were thought necessary some years ago. This is largely due to the admirable work of Lythgoe, whose untimely death was a great misfortune. He thought too much emphasis could be put on acuity, and there are other important factors which are included under the term "visual capacity," which he himself had introduced. Like Sir Duncan Wilson, he had been a member of the Factory Lighting Committee since it was first appointed, but it was mainly due to Sir Duncan's perseverance that there is now some regulation of conditions of lighting in factories. He hoped the suggestion of collaboration with the I.E.S., by means of a joint committee for the study of visual problems, would be followed up. The I.E.S. Code is becoming well established, and Mr. Weston's pioneer work, along the lines suggested by Beuttell, has done much to provide a scientific basis for it.

Replying to the discussion, Sir Duncan Wilson again urged the desirability of closer collaboration between ophthalmologists and the I.E.S. Mr. Weston said he hoped that, whenever possible, ophthalmologists would obtain from patients complaining of eyestrain detailed information as to the nature of their work, and the conditions of lighting to which they were exposed. This would be most valuable to illuminating engineers, as indicating in what respects improvement of lighting practice is most necessary.

Safety Training Exhibition

It is an encouraging sign of the times that the Royal Society for the Prevention of Accidents should find it possible to organise a "Safety Training Exhibition." The exhibition will be arranged at the Dorland Hall (Lower Regent-street, London) for the fortnight starting September 3.

The main object is to encourage the progressive training of young people in accident prevention in every-day life—an obvious need when it is recalled that accidents of all kinds are costing the country 20,000 lives a year.

There will be many interesting exhibits and demonstrations as well as discussions daily during the first week on special aspects of accident prevention. Special importance attaches to the discussion, during the morning of September 6, on "Planning the Home for Safety," when the chair will be taken by Miss Caroline Haslett, C.B.E., and the discussion will be opened by Miss E. Willans and Miss Edna Moseley.

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Black-Out Arrangements in the U.S.A.

It will be recalled that in our last issue (pages 104-105) we referred to the arrangements for the Black-out (or Dim-out) in the United States. quoting from a specification relating to Traffic Control.

Through the courtesy of the British Standards Institution we have since been favoured with copies of three other specifications, issued by the United States Office of Civilian Defence, dealing respectively with "Street Lighting during Black-out," "Black-out Requirements for Highway Movement," and "Black-out of Buildings."

Street Lighting

It has been remarked already that limitations of street lighting in the United States are not general, but are at present, only imposed in certain areas, and may be enforced only during certain periods. The specification assumes that normal street lighting will prevail except when and where black-outs are ordered by the proper military authority, and the curtailment of street illumination at other times is not recommended. Within areas designated, however, various preparations for black-out are advised. These include the provision of switching facilities to ensure that the present street lighting system can be turned off in less than five minutes after the official black-out signal has been given, and surveys to determine locations where an auxiliary black-out lighting system may be found desirable.

Complete elimination of artificial light makes the most efficient black-out. This, however, imposes a serious handicap on the activities of persons engaged in air-raid duties. The inevitable increase in traffic fatalities and the depressing effect on morale are also recognised. It is therefore, prescribed that "the efficient functioning of the whole war effort requires that normal street lighting be maintained, except when a raid is imminent."

The conditions to be aimed at in street lighting during black-outs resemble very closely those adopted in this country. It is prescribed that the illumination over the street on a horizontal surface at street level shall average approximately 0.0003 ft.c., and shall nowhere exceed 0.0006 ft.c. This amount of illumination is approximately double that provided by starlight on a clean moonless night.

Designs of street lighting units to meet the requirements of the specification have been prepared. Their essential qualities are indicated by tables and polar curves limiting the distribution of light for units at nominal mounting heights of 10, 15, and 20 feet. Sketches serving as examples of optical designs for blackout fittings are also presented. Here, again, there is a striking resemblance of the methods adopted in Great Britain.

The specification also agrees with British practice in directing that the light shall be "white" as produced by a tungsten filament lamp operating at approximately its rated voltage. Extensive studies have shown that "blue" light is not suitable for blackout street illumination because (1) it is most easily detected from the air by dark-adapted aerial observers; (2) it provides hazy and indistinct visibility for ground activities; and (3) it becomes useful on the ground only after a relatively long period of dark adaptation of vision.

Appendices contain a glossary of lighting terms, notes on the design of street lighting units, and suggestions for the conversion of gas street lamps to meet blackout requirements. Approval of the design of fittings is to be indicated by the marking of "Street Blackout—War Department Standard" after the units have satisfied photometric tests.

Highway Movements

The next specification dealing with "Blackout Requirements for Highway Movement" commences by emphasising the great importance of allowing sufficient time for eyes to become adapted to the lower illumination. At least five minutes in complete darkness is normally required before eyes become completely dark-adapted. The nature of the blackout equipment required for different types of vehicles is set out in tabulated form. Here again equipment required by the specification must be based on reports submitted to the War

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Department by an accredited Testing Laboratory, after which approved equipment receives the standard marking.

It is interesting to observe that the specification does not advocate the use of luminescent materials out of doors. It is also recommended that all polished metallic and other surfaces shall be covered with lustreless paint so as to eliminate reflection of light in an upward direction.

Blackout of Buildings

The specification on the "Blackout of Buildings" demands either the extinction of all visible lights or the complete obscuration within five minutes after the official signal is given. General directions are given with regard to the use of paint, adhesive coverings, screens and shutters, and the use of light locks for entrances, exits, and ventilation openings, as prescribed. Particulars of indoor lighting units suitable for use during the black-out are included.

It is remarked that, out of doors, phosphorescent materials in general give results little better than those obtainable from ordinary white paint, and the deterioration when exposed to sunlight and weather is emphasised. The possible indoor use of luminescent materials is, however, dealt with in some detail.

It is prescribed that where the glow of fluorescent materials used indoors can be observed from outside the building, surface brightness shall not exceed 0.001 footlamberts, and that the surface brightness of fluorescent materials used out of doors shall not exceed 0.0001 footlamberts.

Company Notices

Mr. W. J. Bird, of the Birmingham Branch of the General Electric Company, Ltd., has been appointed assistant manager of the company's Midland Area. Mr. Bird has been identified with the G.E.C. since 1925. He is also a well-known Rugby footballer, who played in the English Trials in 1935-36.

Mr. A. M. Hicks has been appointed General Manager, and Mr. C. J. N. Borg Deputy General Manager of Siemens Electric Lamps and Supplies, Ltd. They will continue to hold their respective offices of Secretary and Assistant Secretary.

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The Role of Lighting in Accident Prevention

by H. L. LOGAN

An Analysis Conducted in the United States

We have received from Mr. H. L. Logan, who is associated with the Holophane Company in the United States, a reprint of an interesting article dealing with "The Role of Lighting in Accident Prevention."

According to Rear-Admiral W. H. P. Blandy, speaking to the National Safety Congress in Chicago, Illinois, on October 27, 1942, "Since Pearl Harbour almost as many people have been accidentally killed in the United States, including 42,600 war workers, as have been killed by German bombing in England in three years!"

Much is known now about the technique of accident prevention, which has been studied by bodies interested in the "Safety First Movement." The fact that so many accidents depend on *sight*, and therefore on *light*, is not sufficiently understood. The personal experience of everyone supports the statement that an accident is probable in the sudden absence of sight and light. Light, therefore, replaces the probability of accidents with mere possibilities, and these possibilities may be further reduced by the kind of lighting that provides certainty of seeing.

Street Accidents

The black-out has brought home to many people how greatly their safety depends upon visibility. In hours of complete black-out fatalities to pedestrians have increased 400 per cent. over pre-war figures, despite drastic reduction in traffic. Mr. Logan also quotes the results of numerous investigations in the United States of indicating the relation between street accidents and lighting conditions under more normal conditions. One of the most interesting of these was based on the comparison of accidents during the period of 5 a.m. and 7 a.m. (dark in winter and light in summer. It was found that the number of fatalities was almost twice as great in winter as in the summer. When, during the depression, many authorities economised on their street lighting, night accidents invariably increased. Conversely, when the former lighting levels were restored the accident rates once more diminished.

Industrial Accidents

Turning to industrial accidents, Mr. Logan quotes authority for the statement that poor vision (defective eyes and poor lighting) is responsible for 20 per cent. of such mishaps. There are naturally some accidents independent of "seeing," but there is also a large number influenced by light and vision in various degrees. Instances are quoted in which a rise in the level of illumination in factories has diminished the frequency of accidents. In one striking case an increase from 2 to 19 ft.c. diminished the accident rate 54 per cent. It is quite evident that the lower the illumination the greater the likelihood of imperfect seeing, and the greater the number of accidents due to this cause.

Relation of Accidents to Lighting

In the latter part of his contribution Mr. Logan sought to obtain a diagram showing how the proportion of accidents caused by inadequate lighting is related to the available illumination. It is possible to identify various stages in this relation. For example, if we were completely deprived of sight or light and still forced to go about our business, we should certainly suffer accidents. The relation of visibility to accidents would then be 100 per cent. Experience shows that with the reduced street lighting available in a severe black-out the accident rate may be *seven times* that which occurs in the same localities in daylight. It may be inferred, therefore, that the factor becomes 87½ per cent., as compared with 100 per cent. for complete absence of light.

On the other hand, it is obvious that no amount of light can protect against accidents in which the events move faster than the speed of vision. The other end of our light-accident curve

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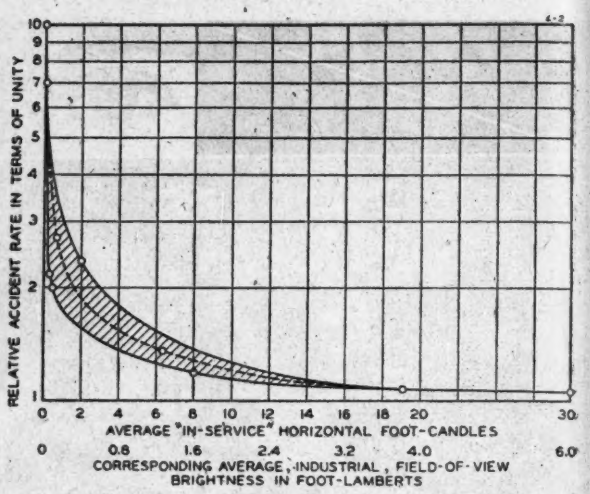

Fig. 1. Showing the Relation of Lighting to the Accident Rate. "Unity" represents a condition when all accidents have a non-visual cause, which is only approached at a relatively high illumination.

must therefore be the brightness level at which the speed of vision reaches the maximum. Here Mr. Logan is on safe ground in quoting from established data, which indicate that at about 90 ft.c. we have reached a point beyond which increased brightness affects only slightly the speed of vision. This value, therefore, might be taken as the other extreme of the curve.

In order to get opinion in regard to intermediate points, Mr. Logan explores data available for various industries and the corresponding illumination.

He thus deduces the diagram shown in Fig. 1, which shows the relation of lighting to the general industrial accident rate.

Further data in regard to specific industries leads to a discussion of the proportion of total accidents attributable to lighting conditions, as a function of the illumination provided.

Mr. Logan shows, for example, that the proportion of accidents occurring in the steel industry under artificial lighting that can be attributed to uncertain seeing conditions is about 29 per cent. A higher figure can be anticipated in industries which are less well lighted. By such means he arrives at Fig. 2. It will be noted that this terminates at 30 ft.c., the subsequent portion of the curve up to 90 ft.c., which is relatively unimportant, being omitted. The relation shown in Fig. 2 is, as the author frankly admits, based on "educated guesses." It is, however, an interesting basis on which to view the relation between illumination and risk of accidents, and in principle is doubtless substantially correct.

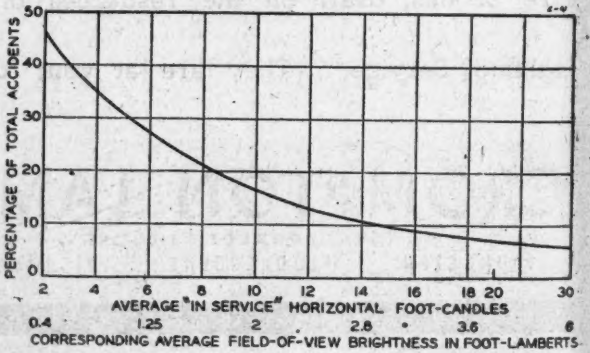

Fig. 2. Showing how the number of accidents attributed to lighting causes, as a percentage of total accidents, diminishes progressively as the illumination rises. The curve is becoming horizontal as 30 ft.c. is approached.

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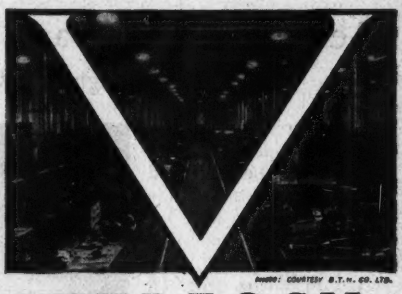

Photo: Courtesy B.T.H. Co. Ltd.

VITREOSIL *in* FACTORY LIGHTING

Improvements in factory lighting have been accelerated by the war. One of the newest developments in lighting, the super-pressure Mercury Vapour Burner has only been made possible by reason of the well-known heat resistance of fused silica. Transparent VITREOSIL, pure fused silica, has been manufactured for over 30 years and is used in these new lamps of high efficiency.

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Relighting of an Engineering Works

Fluorescent Lighting Replaces Tungsten Lamps

An interesting change-over to modern lighting has recently been carried out in an old-established engineering works which, under pre-war conditions, was able to carry on with a tungsten lighting installation that just sufficed. The general effect was gloomy and depressing, the lighting points being positioned incorrectly in an attempt to serve the dual purpose of general shop lighting and local machine tool lighting. (See Fig. 1.)

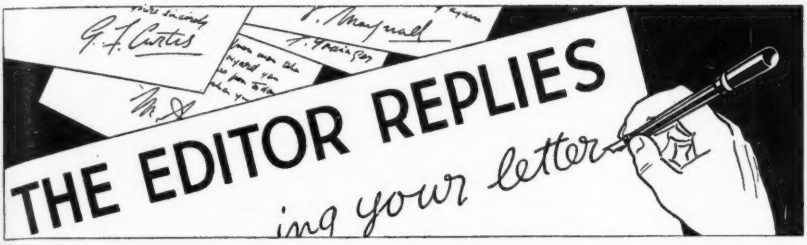
Fig. 1. Showing the original lighting with tungsten lamps, giving a gloomy and depressing effect.

Power was provided for the main shop by means of central electric drive operating line and counter shafting; under tungsten lighting the mass of belts and pulleys and shafting supported on steel gantries caused heavy shadows. The machine shops are to-day devoted to essential war production of the precision class requiring the best available illumination.

New methods of lighting, based on the substitution of "Sieray" fluorescent tubes were accordingly adopted. The improvement is clearly illustrated in Fig. 2. The lighting is giving every satisfaction, though the total load is no greater than before and local lighting of machine tools is no longer necessary.

Fig. 2. Showing improved lighting with fluorescent tubes, giving a greatly improved effect.

The planning of the new installation was undertaken by Messrs. Siemens Electric Lamps and Supplies, Ltd., in collaboration with the contracting engineers, Messrs. G. Hopkins and Sons, Ltd.



I have received a very interesting letter from Mr. Percy V. Burnett, commenting on the discussion on Daylight in our last issue. He supports the belief that the **Daylight Factor** *is* generally applicable, for example, in countries where the sky brightness is higher than in Britain. Experience seems to prove that the well-known "grumble point" of 0.2 D.F. is inadequate, whether the sky-brightness is 500 or 5,000 ft.c.—so that though the sky-brightness in different countries may vary, the human eye does not.

In latitudes nearer the equator the problem is affected by the fact that **the heat of the sun** has to be excluded, and windows are accordingly small in very hot countries. Nevertheless, Mr. Burnett points out, the windows in modern office buildings in Cairo or Rio de Janeiro differ little from those in London, though movable blinds, etc., are used to keep out the sun when its heat becomes a nuisance. Little research has yet been done in such countries. But there seems no good reason to assume that what applies in Britain would not also apply in India.

Mr. Burnett also concludes from wartime experience that **people prefer a room** into which **some daylight enters.** He cites the case of a blacked-out factory in which the admission of only a small amount of daylight through the roof removed complaints by workers, though work was still done by artificial light.

Mr. J. H. Nelson likewise stresses the value of windows, but for the reason that most people like to be able to **see out of a room**—to relax their eyes by a distant view. In this respect clear glass is greatly preferable to the usual netted or translucent window.

Our reference to the introduction of **"half-moon" traffic lights** during daylight hours in London has brought a letter from Mr. J. Lightbown, of the Nuneaton Electricity Department, who tells me that the signals in Nuneaton were converted in this way as far back as October, 1939. In the first experimental masks the daylight aperture was a 3-inch diameter disc in addition to the normal cross, but later this was altered to the full "half-moon" type.

I am likewise informed by Mr. P. J. Robinson, the city lighting engineer for Liverpool, that similar arrangements were made for the traffic signals there in 1940-41. An interesting feature in that case is that the system is automatically controlled and has proved quite effective and reliable in service.

Obituary

A. E. SCHUIL

We learn with great regret of the death of Temp. Lieut. A. E. Schuil, R.N.V.R., on April 18 as the result of enemy action whilst he was engaged on a special mission. He had been seconded from the research laboratories of the General Electric Company, Ltd., which he joined in 1937. He was a member of the Illuminating Engineering Society and contributed a paper on "The Effect of Flash Frequency on the Apparent Intensity of Flashing Lights" in 1940. He was a fine experimenter who had done valuable work during the war, which cannot yet be made public. It is indeed sad that a career of such great promise should have thus been brought to an end.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from p. 110, July, 1943)

SOURCES OF LIGHT AND MATERIAL

49. Cold Cathode Tubes in Industrial Lighting. Wendell Phillips. El. World, 119, p. 1286, April 17, 1943. In a large American factory a direct comparison is being made between an installation using hot cathode tubular discharge lamps ("fluorescent tubes") and high voltage cold cathode tubes. Every effort was made to dispense with critical war materials, and it is claimed that the high voltage tubing has very great possibilities, as the efficiency is high. S. S. B.

50. What's Different About Cold Cathode? A. C. Barr and C. M. Cutler. El. World, 119, p. 1438, May 1, 1943. The authors describe the construction and operation of the high voltage cold cathode discharge lamp, and explain the fundamental differences between the hot cathode and cold cathode types of lamp. From these they contrast the resulting influence on application in lighting systems. S. S. B.

51. Five Ways to Save Fluorescent Lamps. E. W. Beggs. El. World, 119, p. 1322, April 17, 1943. Five points are quoted, to which proper attention will prolong the life of fluorescent tubular lamps. Details of procedure are given, and the importance of careful maintenance emphasised. S. S. B.

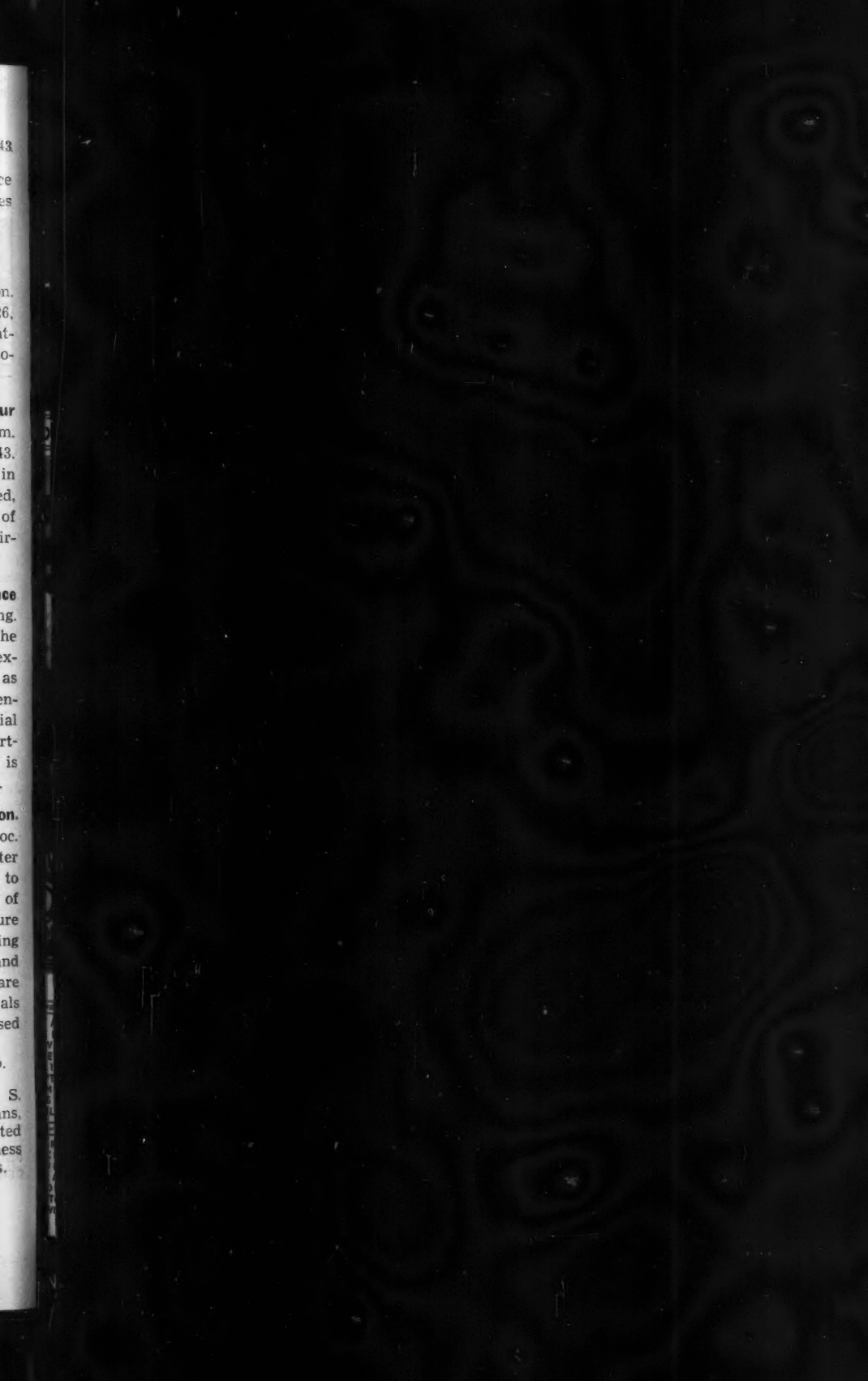
52. 460-volt Series Lighting Saves Copper. George E. Shoemaker. El. World, 119, p. 594, February 20, 1943. The application of series lighting circuits to the lighting of American industrial war plants is described. A 460-volt supply is used. A very considerable saving in copper in conductors is obtained, and subsidiary gains in lamp efficiency, life, and ease of maintenance increase the advantage of the series system. S. S. B.

APPLICATIONS OF LIGHT

53. Modern Lighting Practice. Anon. Am. Illum. Eng. Soc. Trans, pp. 223-226, May, 1943. Some representative lighting schemes are described with photographs. J. S. S.

54. Engineering Twenty-four Hour "Daylight." C. F. Prideaux. Am. Illum. Eng. Soc. Trans., pp. 227-250, May, 1943. A number of lighting installations in large engineering plants is described, with particular reference to the use of fluorescent lamps in windowless air-condition buildings. J. S. S.

55. Lighting for National Defence Buildings. E. W. Moore. Am. Illum. Eng. Soc. Trans, pp. 300-306, June, 1943. The problem is reviewed in relation to experience in Canada, such aspects as urgency, suitability, economy maintenance, power conservation, and material available being considered. The importance of light, as an essential tool, is strongly emphasised. J. S. D.

56. Lighting and War Production. W. G. Darley. Am. Illum. Eng. Soc. Trans., pp. 307-325, June, 1943. After briefly discussing lighting in relation to safety, the author reviews methods of general lighting and suggests procedure for lighting with various mounting heights. "Critical materials" and "Smashing production bottlenecks" are next discussed. Finally the author deals with supplementary and specialised lighting, illustrating various devices. J. S. D.

57. Experiences with the Dimout. S. G. Hibden. Am. Illum. Eng. Soc. Trans, pp. 251-263, May, 1943. Methods adopted in America to reduce sky brightness above cities are described. J. S. S.